

Industry Horizons: Electronics & Photonics Technology Office

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Electronics & Photonics Technology Office (EPTO)

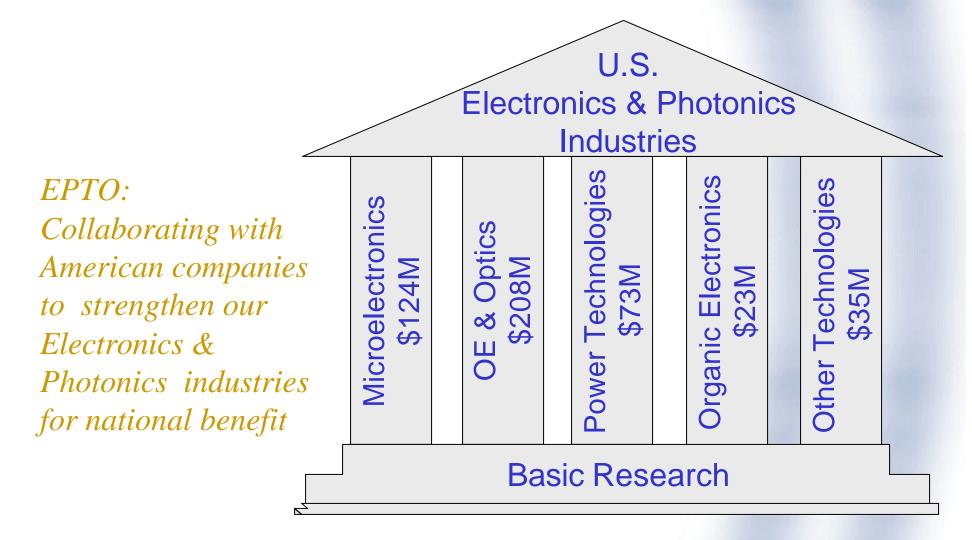
- Focused on supporting projects in:
 - Microelectronics
 - Optoelectronics & Optics technology
 - Power technologies
 - RF electronics
 - Organic electronics
 - Manufacturing

Working with American companies to fill the gap between the laboratory and the marketplace through early stage investment in new ideas and new technologies in electronics and photonics





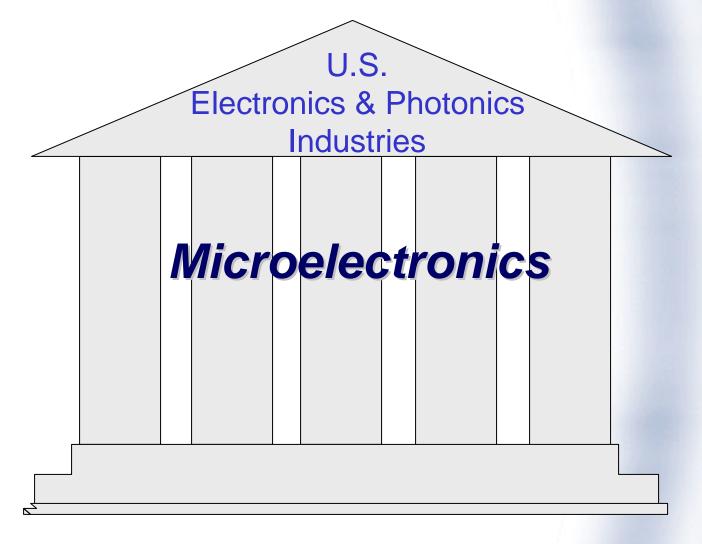
EPTO Funding for Active Projects







EPTO







Directions in MicroElectronics

μ elex roadmap

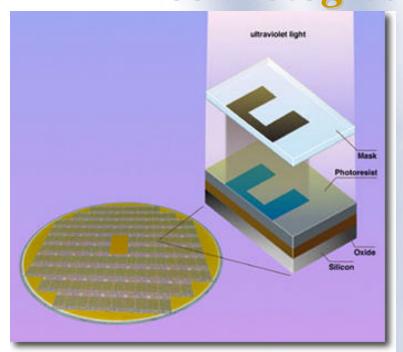
- The Pace of Silicon Technology is Quickening
 - 64 billion transistor DRAMs
 - 0.5 billion transistor / 6 GHz micro-processors by 2009
 - 100 nm and beyond device technology is occurring sooner rather than later.
- Suppliers of advanced equipment, materials, and devices are increasingly becoming the focal point of innovation for tomorrow's systems.
- Integration of added electrical, optical and mechanical function within existing technologies holds the key to future products.
- Manufacturing technologies and efficiencies underscore many of industry's biggest issues and are central to maintaining U.S. global leadership.

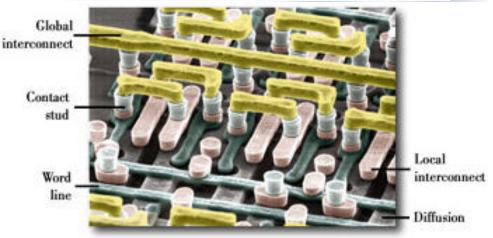




Semiconductor Lithography & **Technologies**

- Process used to fabricate integrated circuits (ICs).
 - Over 30% of production & facilities cost.
- Technology driven by reducing dimensions and cost/function.
 - Requires tools for manufacturing ICs with dimensions below 100 nm.
- Industry constantly challenged to manufacture
 - Smaller
 - Cheaper
 - **Faster**
 - Greater processing power









Gas-Cluster Ion-Beam Manufacturing Tool for Next-Generation Semiconductor Devices

Objective

Develop a prototype GCIB & validate manufacturing performance & applications.

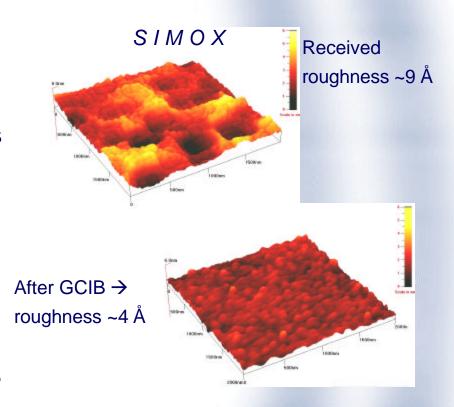
- 2X to10X decrease in surface roughness
- Wide range of semiconductor surfaces
- Stimulate emergence of smaller thin-film devices
- Enable new depth-profiling tools and new paths to nitride-film deposition.

Core Innovations

- lonized gas beam forming apparatus.
- Methods to generate high beam currents and rapid wafer throughput.

Key Technical Challenges

- High cluster-flux nozzles and ionizers.
- lon-beam transport optics and filters.



EPION Corporation

Billerica, Massachusetts

Project Start/End Dates:Oct 98 to Oct 01





Intelligent Mask Inspection Systems for Next Generation Lithography

Objective

Accelerate the development of NGL reticle inspection tools.

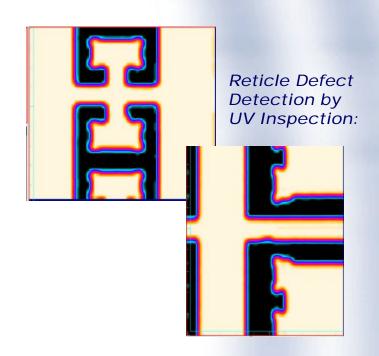
- Develop prototype tool
- Implement innovative techniques for defect disposition based on defect printability.
- Provide data to optimize reticle designs for better inspectability.

Core Innovations

- High speed & resolution image acquisition
- High speed image modeling
- Efficient defect detection algorithms

Key Technical Challenges

- Unknown defect population
- Unknown defect characteristics
- Meeting defect detection sensitivity
- New materials and structures

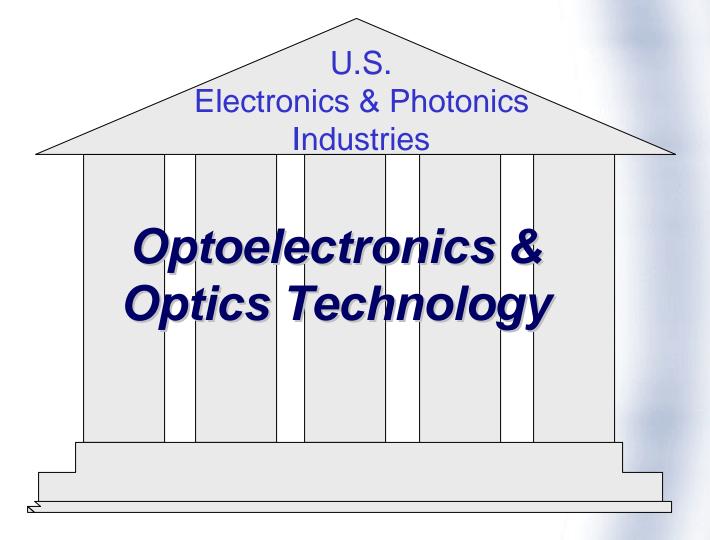


KLA-Tencor, Lucent Technologies EUV-LLC, DuPont Photomask, Photronics. Project Start/End Dates: 5/10/99 to 5/9/01





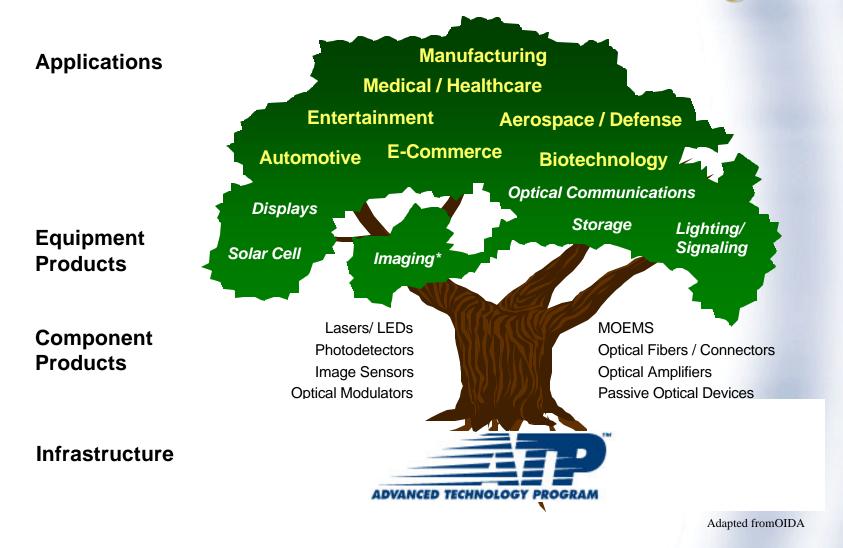








Optoelectronics An Enabling Industry







Industry's Key Issues for Competitiveness

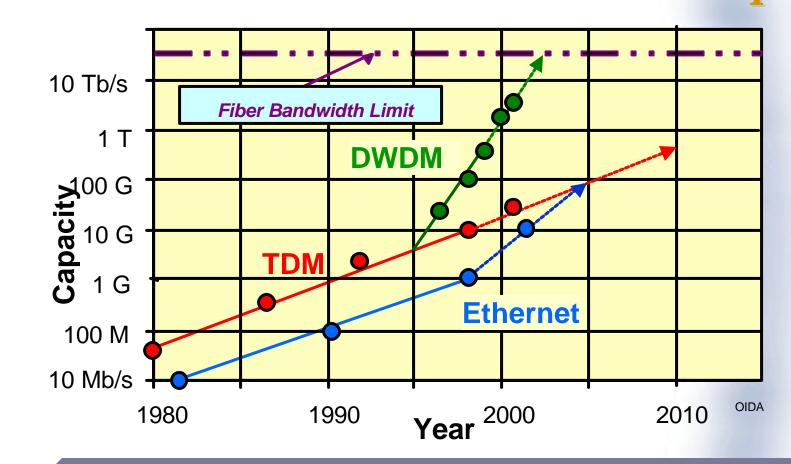
- A strong manufacturing infrastructure and efficient production is critical to successfully capture and maintain market share
- Large targeted capital investments are required for high volume markets
- Significant price erosion 12 to 15% or more - is the norm for optoelectronics products



Source: OIDA



Communication Bandwidth Explosion



Supporting Industry with Infrastructure Beyond Copper





An Integrated Simulation Environment for Photonics Manufacturing

Objective

Develop open, integrated, multilevel computer simulation environment for photonics equipment at component through system levels quickly, reliably, & inexpensively before they are built.

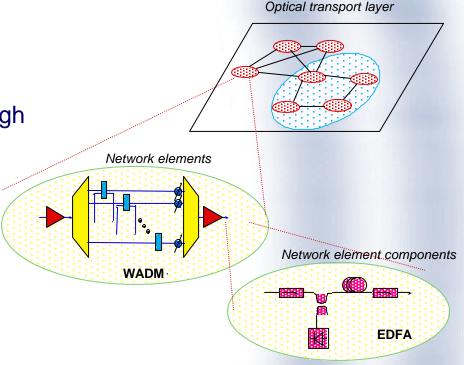
Increased product reliability, yield, & manufacturability.

Core Innovations

- Framework technology.
- New photonics models.

Key Technical Challenges

- Vertical interfaces in framework.
- Model speed and accuracy for product design.



SAIC, Telcordia Technologies,
Nortel Networks, Agilent Technologies,
SDL,RSoft, Columbia University
Project Start/End Dates: 2/15/99 - 2/14/04





MOEMS Manufacturing Consortium

Objectives

Develop a robust MOEMS manufacturing process. (Mirco-Optical-Electro-Mechanical) Integrate photonic components with MOEMS devices.

On-chip assembly and alignment of MOEMS optical systems.

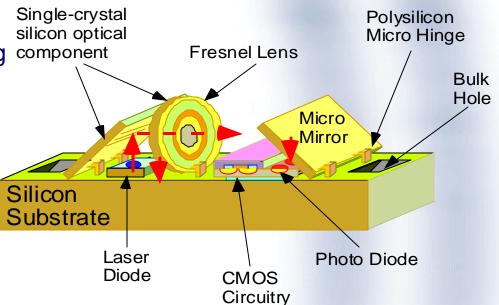
Extened MEMS computer aided design tools for MOEMS design.

Core Innovation

 Integration of bulk with surface micromachining.

Key Technical Challenges

- Polysilicon limitations
- Use of on-chip sensors and actuators for self-assembly.

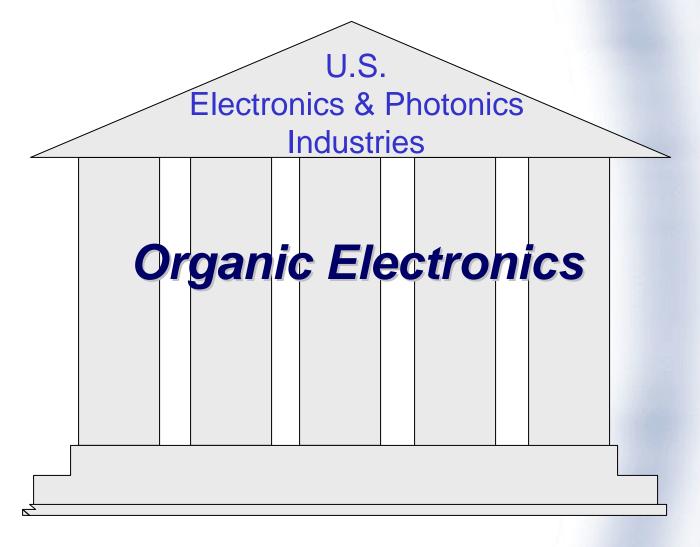


Xerox, Maxim, Microcosm, Microscan, Optical Micro-Machines, Standard MEMS Project Start/End Dates: 1/99-12/01





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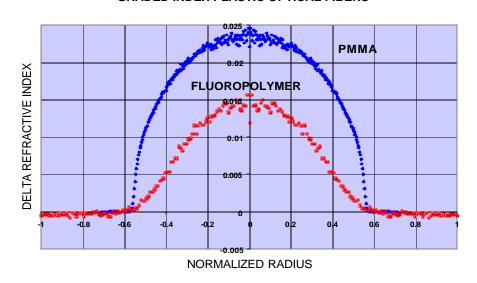
Organic Electronics

Innovative electrical / optical devices or components derived from organic materials and process technologies wherein those materials participate in or are essential to the functions that occur within electrical or optical systems

Functions include:

imaging or patterning, logic, memory, interconnection, power or sources, display or illumination, field protection or confinement, sensing, actuating, etc.

GRADED INDEX PLASTIC OPTICAL FIBERS





Supports ...

microelectronics and photonics manufacturing;
power technologies;
large-area-, disposable-, and molecular-electronics;
MOEMS;
smart structures, and;
trends towards broader integration of functions within electrical/optical systems





Optical Polymers and Processes for Low-Cost DWDM Systems

Objective

Manufacture low cost optical DWDM devices for the telecommunications market. $\lambda_1 - \lambda_{16}$

 Considerable cost reduction through component integration. Low cost enables expansion of optical communications to broader base at the local level.

2x2 Switch DROP λ

Core Innovations

- Optical Cross-connect Switch
- Optical Add/Drop Multiplexer

Key Technical Challenges

Polymer material to specifications

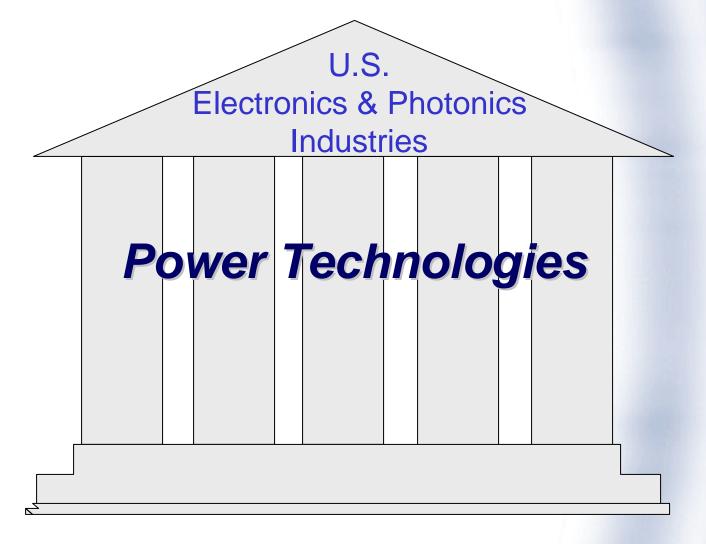
Lightwave Microsystems, BF Goodrich

Start/End Dates: 1/99-12/02









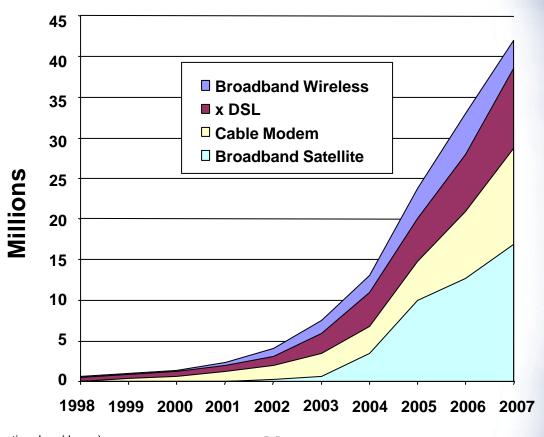




U.S. Residential Broadband

Access

Subscribers by Connection Type, 1998-2007



Source: Global Information, Inc. (Japan)

Year

Supporting Infrastructure for Wireless Technologies

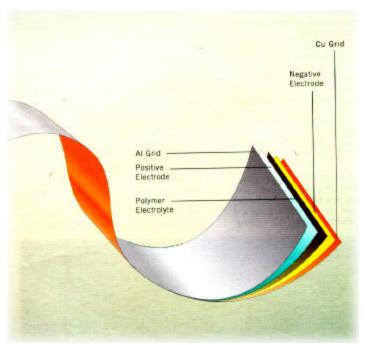




Power Technologies

Power technologies critical to the changes taking place in the way people communicate and use electricity:

Wireless Electronics...Broadband Communications...Distributed Power...EVs





Critical Technologies:

- Fuel Cells
- Advanced Rechargeable Batteries
- Photovoltaic Solar Modules
- Ultracapacitors
- Flywheels
- **Microturbines**





Distributed Premium Power Fuel Cell Systems

Incorporating Novel Materials and Assembly Techniques

Objective

Develop a high reliability, greatly simplified, CO tolerant PEM fuel cell system

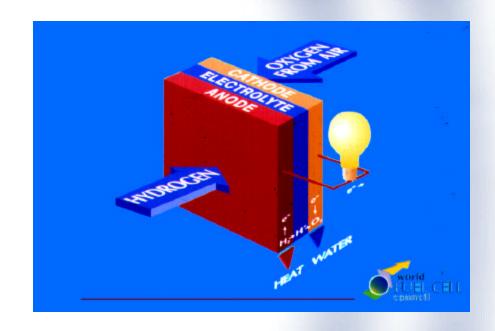
- ? Improves CO tolerance by 20X
- ? Important steps to \$1000/kW
- ? Improves reliability

Core Innovations

- First high CO tolerant solid polymer membrane electrode assembly
- New catalysts
- CO clean-up procedures
- New bipolar separator plates

Key Technical Challenges

- Ion conductive polymer membranes
- Systems integration into a high temperature fuel cell stack



Companies: PlugPower, Polyfuels, SRI Project Start/End Dates: 5/10/99-5/9/2001



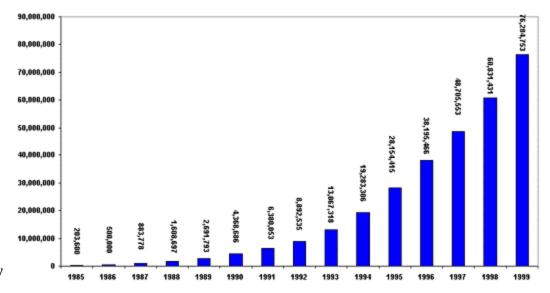


RF/Wireless Electronics

Wireless Subscribership: June 1985 - June 1999

Factoids

- Heresy 10 years ago to think that a wired home phone might be replaced by a wireless phone
- ✓ 84,156,251 U.S. wireless subscribers on 19 January 2000 at 10:29 a.m.
- ✓ 1 billion mobile phone subscribers worldwide by 2004
- ✓ Wireless phone population will equal or exceed wired phone by 2004
- Wireless access will be POTS of tomorrow



RF/Wireless Electronics

Significant contributor to meeting the 4 "Anys" of telecom

- Anywhere -- Broad coverage
- Anything -- Multimedia
- Anytime -- High reliability
- Anybody -- Affordable universal service

Technology Challenges

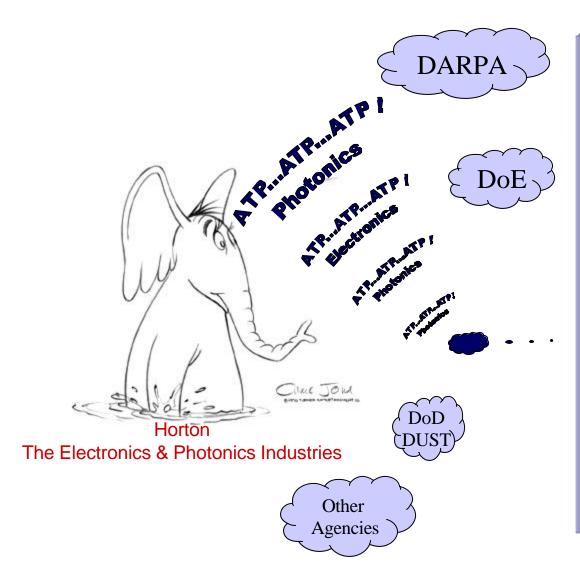
Some Enabling Technologies

- digital integrated circuits
- RF generation devices
- source coding
- multiple access techniques
- error correction coding
- software programmable radios
- backbone system elements
- performance modeling and verification





We are Here... We are Here ... We are Here!



Our unique mission fills a critical niche

but

Not exactly as traditional Federal R&D

Continuous education & outreach are required to promote ATP's mission & criteria

Further incentives to attract quality projects to ATP?

